

Invisible bacteria get free ride in the city air, threatening human health

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Airborne pathogens, bacteria capable of causing infections in the lungs, gut, mouth and skin, are twice as abundant in densely populated parts of Delhi compared to less crowded regions.

Indo-Gangetic Plain (IGP) in India is one of the most densely populated regions in the world with highest air pollution. During winter, entrance of western disturbance causes sudden drop in atmospheric temperature, thereby subsequently increasing relative humidity (RH), which is responsible for stagnant wind and low boundary layer height, favouring accumulation of lower atmospheric pollutants over IGP. Delhi, an urban region within IGP, is most populous and rapidly growing city in the country and one of the most polluted cities of the world.

A significant increase in airborne microbial population has earlier been reported in winter over IGP. However, there is limited information regarding the effect of meteorology, air pollution and population on airborne bacterial communities that can help understand their impact on human health.

A study of health risks posed by airborne pathogens over urban metropolitan city like Delhi in India by scientists from Bose Institute, an autonomous institute of Department of Science and Technology (DST) has revealed for the first-time that airborne pathogenic bacteria mainly responsible for Respiratory, Gastro-Intestinal Tract (GIT), Oral and Skin infections are two times higher over densely populated urban regions due to higher concentrations of tiny particles PM_{2.5}.

PM_{2.5}—the microscopic dust specks help bacteria to hitch ride through the city air. Since the particles are small enough to sneak deep into the lungs they act as carriers of the pathogenic bacteria, thus spreading the infection to different parts of the body.

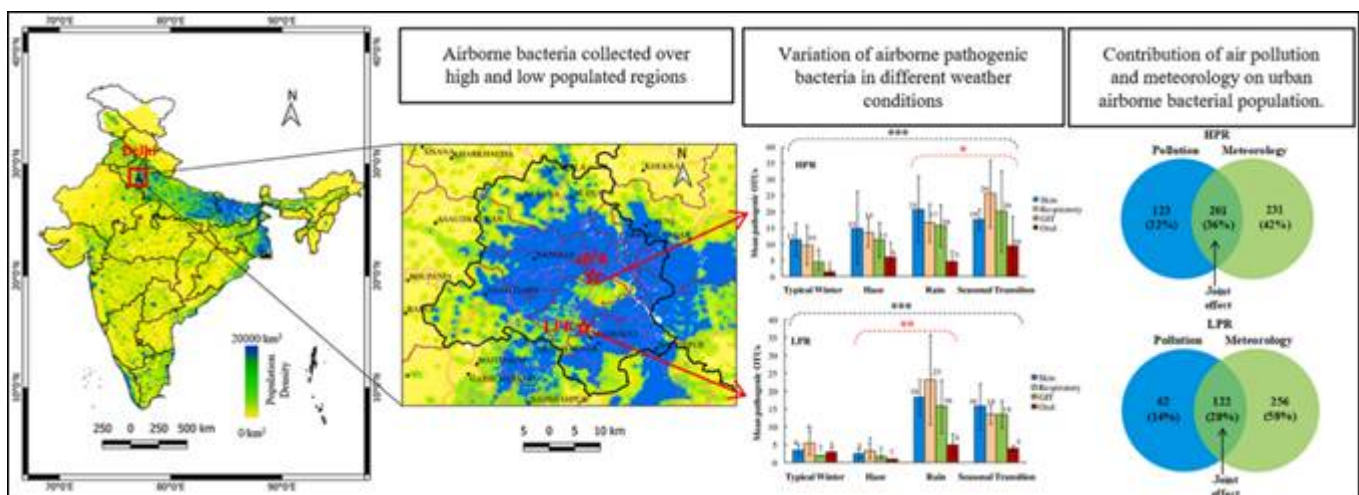


Fig: Population dependent alteration in urban airborne pathogenic bacterial community over Delhi: A comparative investigation between airborne bacterial communities over high populated region (HPR) and low populated region (LPR) within Delhi city, as shown in the above figure.

The research led by Dr. Sanat Kumar Das found that the transition from winter to summer, especially during hazy days or winter rains, creates high-risk windows when airborne diseases are more likely to spread. During these periods, the cocktail of pollution and weather patterns creates the perfect storm for microbes to linger in the air longer than usual. Link to the published paper: (<https://doi.org/10.1016/j.aeaoa.2025.100351>)

The study published in an international journal, named 'Atmospheric Environment: X' could be a wake-up call for urban health planning. Megacities like Delhi, where millions breathe in polluted air daily, may also be exposing residents to invisible bacterial communities enriched with pathogens. Understanding how weather, pollution, environmental factors and population density affect these airborne bacteria and resultant disease transmission, could help governments and health experts better predict outbreaks, improve urban design and protect citizens.

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